# CHAPTER 4
# CONSTRUCTION PLANNING AND ORGANIZATION

## PURPOSE

a. Careful construction planning cuts costs and creates an orderly sequence for the project.

b. Construction planning enables the manager to--

(1) Determine the tasks.

(2) Establish priorities.

(3) Determine time schedules for each task and for the entire project.

(4) Identify personnel and equipment needs.

(5) Forecast requirements for materials and special equipment to prevent delays.

(6) Establish responsibility.

c. Effective port construction planning requires--

(1) Reconnaissance and study of the proposed port site.

(2) Estimates of material, equipment, and personnel.

(3) Consideration of nonorganic equipment.

(4) Preparation of construction time schedules.

(5) Knowledge of unloading capacities.

## CAPABILITIES OF CONSTRUCTION FORCES

The engineer unit responsible for major port construction or rehabilitation is the engineer construction group. It includes an engineer port construction company or companies, pipeline construction and support companies, engineer combat (heavy) battalions, dump truck companies, engineer construction support companies, dredge teams, and other units the mission may require. When several groups work together, they are organized as an engineer brigade with various capabilities.

a. The headquarters and headquarters company in an engineer construction brigade supervises a force of two to four engineer construction groups and supporting troops--5,800 to 15,000 soldiers.

b. When organized for port construction, an engineer construction brigade can plan and carry out any port construction or rehabilitation project in military operations.

c. The engineer construction group is a flexible organization. It becomes operational only when working units are assigned or attached to it. The headquarters and headquarters company in an engineer construction group command supervises three to five engineer combat (heavy) battalions or their equivalent in assigned or attached troops. Two or three combat (heavy) battalions and at least one port construction company help organize the group for typical wharf construction. Pipeline construction support companies, dredge teams, construction support companies, and dump truck companies are added as required.

d. The engineer combat (heavy) battalion is the basic unit assigned to a specific project or to separate minor projects. When working on port construction projects, the battalion can draw on several sources. It can have a port construction company, pipeline construction support company, dump truck company, construction support company, and dredge team.

e. The engineer port construction company operates as one element of a large-scale, coordinated construction operation under an engineer group. It can serve separately on minor projects at separate locations. Its main activities are construction or major repair of waterfront structures and POL off-loading facilities and anchorages. It is better to assign related on-land sub-projects to a construction battalion or other specialized unit. The port construction company should handle specialized waterfront construction. It is organized for two-shift operation. Its equipment includes crane-shovels with attachments for dredging, excavating, pile driving, and other work; pipeline equipment; hydraulic jacks; air compressors; pumps; tractors; concrete mixers; barge assembly sets; diesel-powered outboard propelling units; bridge erection boats; and landing crafts, mechanized (LCMs).

f. The pipeline construction support company provides technical skills and special equipment to assist engineer units. It can work separately on minor projects. It is normally attached to a construction group on the basis of one per construction battalion.

g. The engineer dump truck company augments the earthwork capabilities of other units. It operates 48 dump trucks on a two-shift basis. The trucks are loaded by the supported unit.

h. The engineer construction support company is assigned to an engineer group to provide equipment and operators for large-scale earthmoving, quarrying, or surfacing work.

i. Engineer dredge teams of TOE 5-500 (Series) are assigned to operate organic cutter-head pipeline or seagoing hopper dredges. Other types of dredges are best operated by local personnel.

j. Other units required for engineer service may include forestry, topographic, intelligence, maintenance, fire-fighting, and utility units.

## FLOATING PLANT AND SPECIAL EQUIPMENT

Floating plant items used in the construction, rehabilitation, and operation of a harbor include--

a. Lighters, barges, and rafts. These include lighters and barges for general cargo, fuel oil barges, fresh-water barges, and rafts to haul piles and do general work on offshore structures. They may be towed or self-propelled. Their simple design and shallow draft allow them to perform well in construction work. Binges and lighters are made self-propelled by installing 165 horsepower outboard motors from the port construction company.

b. Tugs. These vessels tow lighters, barges, or rafts, and assist ships in berthing and unberthing.

c. Amphibian vehicles. These units handle cargo during beach operations. If available, they supply an offshore construction job.

d. Floating cranes. These are available to transportation or engineer units.

e. Floating pile drivers. The engineer port construction company provides either the drop hammer or diesel-powered hammer floating pile drivers. See Figure 4-1, page 4-4.

f. Floating marine repair shop. This shop includes fully equipped machine, electrical, engine repair, carpenter, blacksmith, pipe, and welding equipment. Mounted on a nonself-propelled barge, it is used to repair floating equipment in harbors and adjacent areas. It may be used when opening and rehabilitating captured ports.

g. Landing craft. During the first phase of rehabilitation or new port construction, LCMs deliver construction material, equipment, personnel, and supplies over beaches.

## CLASS IV SUPPLIES

Class IV supplies include construction materials and installed equipment. After initial occupation, supplies received from the continental United States (CONUS) follow an automatic rate prescribed by Department of the Army. At a later stage, the basis of supply changes from automatic shipment to requisition. Theater requisitions for engineer construction materials must include project requirements for special large-scale operations. Issues from stocks are based on these requirements. The G-4 approves issue of critical items of Class IV supplies. Uncontrolled items are issued on call.

## AVAILABILITY OF LOCAL MATERIALS

Providing engineer construction supplies to a modern Army from CONUS is a large, complex, and costly operation. Local procurement is better where possible. The project officer maintains a continuous inventory of stocks of construction materials and equipment available locally. Class IV supplies suitable for local procurement may include lumber, cement, structural steel, sand, gravel, rock, plumbing and electrical supplies, hardware, and paint.

## AVAILABILITY OF LOCAL LABOR

Local port authorities may provide technical assistance on electrical circuits, operation of tidal locks, and cargo-handling equipment. They may also give information on foundation conditions. Personnel in port reconstruction units should draw experience from civilian construction firms. Prisoners of war may be a source of highly skilled workers.

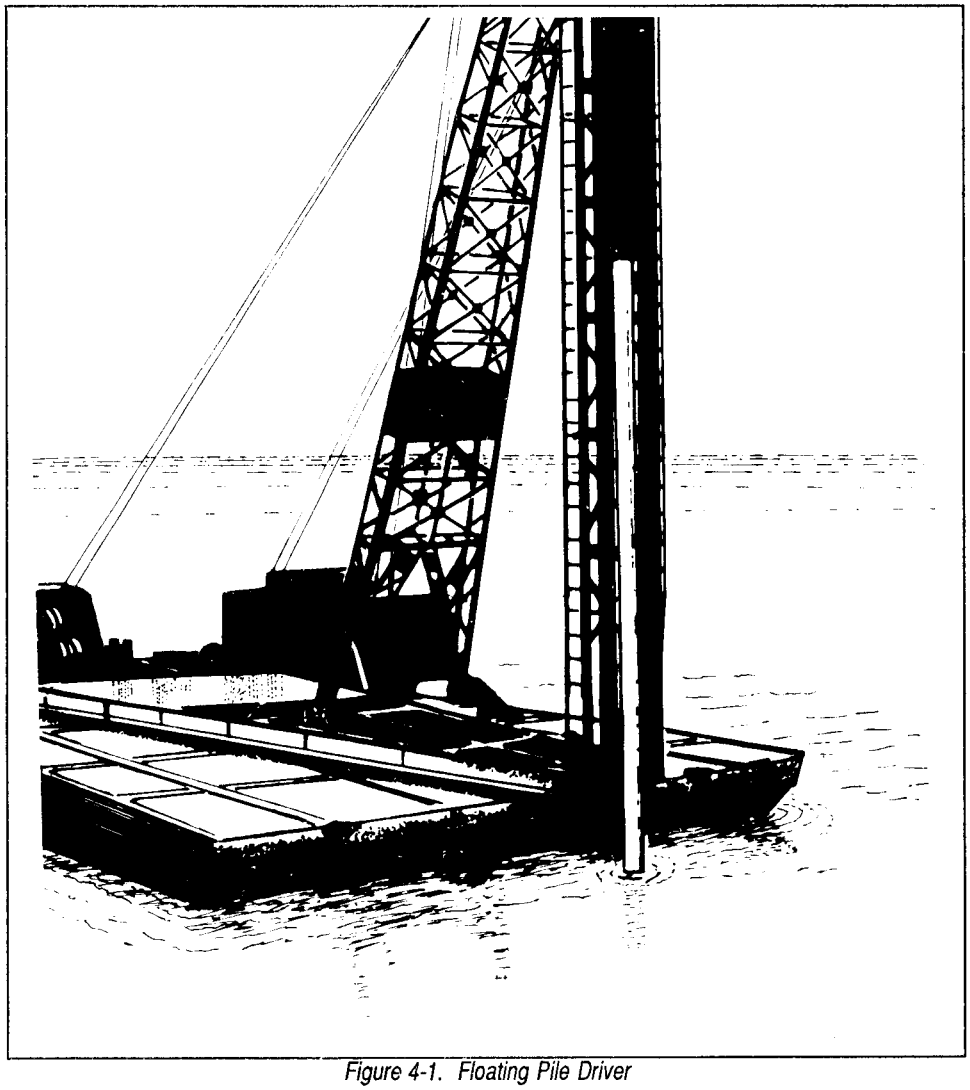

*Figure 4-1. Floating Pile Driver*

## CONSTRUCTION PLANNING

a. Planning stage (TM 5-333). Military construction makes it advisable to divide the planning phase into two stages:

(1) Preliminary. This consists of a quick overall review of the assigned task and the capability of the constructing unit. It includes an estimate of critical items to be procured. Preliminary planning guides the detailed planning which follows.

(2) Detailed. This results in an estimate of the materials, labor, and equipment needed to accomplish each sub-task in the project and a time schedule for the entire project. It includes--

* Review of drawings and specifications.

* Detailed estimates.

* Schedules.

* Procurement.

* Construction plant layout.

b. Construction schedules. Construction schedules for projects may be represented by a bar diagram or a network analysis. A major port construction or rehabilitation project uses the critical path method (CPM) of network analysis. The CPM provides a method of handling critical tasks which sets the duration of the project. It warns the manager where he can expect trouble in meeting schedules.

c. Progress reports. The CPM helps to predict the day-by-day progress in terms of percentage of completion. Daily reports indicate how the job stands.

d. Allocation of equipment and material. The CPM indicates tasks engineers must do in early phases of construction to maintain the scheduled rate of progress. Priority goes to securing material and equipment required for these tasks. Tools and equipment are assembled in advance and prepared for use.

e. Delivery schedules for materials.

(1) General. Schedules for the delivery of material depend on site conditions, construction methods, work priority, and availability of supplies. The CPM can establish the materials required and the date they must be on the site.

(2) Bill of materials. Consolidated list of required materials.

**PHASES OF RECONSTRUCTION**

Port reconstruction is generally carried out in three phases:

a. Phase One.

(1) Subject to operation orders, the Navy carries out major clearing, salvage, and dredging for channels and slips. In an area intended as a naval base, Navy units construct other facilities. In areas intended for ground-force use, the Navy only opens waterways and frees them from mines and similar hazards.

(2) Operation orders for the assault of a port area state the engineer missions in the port area as well as arrangements for liaison between ground forces and naval units.

(3) During phase one, engineer construction units reconnoiter harbor facilities and routes of communication. They note beach improvements and interim facilities available from shore-party activities. They restore any accessible deep-draft or lighter wharfage not heavily damaged. They consider possible uses for vessels sunk alongside piers or wharves, and consult naval units for advice and assistance in improvising wharf decks over their hulls.

b. Phase Two.

(1) Initial construction: Engineers rehabilitate existing port structures. They use expedient methods of lightening and port construction to handle cargo.

(2) Existing noncontainer cargo ports.

* Continuation of Phase One by shore parties.

* Construction of floating wharf structures with Navy pontoon gear or Army floating bridge equipment, if available.

* Erection of self-elevating DeLong barge piers, if available.

* Expedient repair of existing structures.

* Lightering with TOE equipment.

(3) Existing container ports.

* Continuation of Phase One by shore parties.

* Construction of floating container wharf causeways with modified Navy pontoon gear and self-elevating DeLong barges.

* Repair of existing container wharves by any expedient method possible.

* Lightering with TOE equipment.

(4) Future military container ports. Current recommendations are that all military ports constructed in the future be suited for container handling. The recommended design specifies the use of large self-elevating, spud-type barge pier units. These can support live deck-loads of 1,000 pounds per square foot. These barge pier units are equipped with pedestal-mounted off-loading cranes and self-propelled engines. They can be raised or lowered 50 feet per hour. This capability allows undamaged units to perform the following tasks during rehabilitation:

* Serve as lighters during repair of the damaged units.

* Form into smaller freed-pier units, depending on the size of ships to be accommodated.

* Use pedestal-mounted off-loading cranes in clean-up operations.

c. Phase Three.

(1) Existing noncontainer ports.

* Repairable wharf structures are now permanently rehabilitated. Structures are limited to a live-deck load of 500 pounds per square foot.

* New unloading facilities are constructed. Plans for standard structures limit the live-deck load to 500 pounds per square foot.

* Work on highways, railways, canals, and storage facilities outside the wharf area of the port continues. It must keep pace with the development of berthing and unloading facilities at the waterfront.

(2) Existing container ports. Similar to the third phase of existing noncontainer ports, but special designs or modified AFCS designs for port decks must support live loads of 1,000 pounds per square foot or more.

(3) Future military container ports. Recommended designs for future military container ports are planned for expedient construction. The third-phase work for these ports is limited to adjoining facilities.

## CLEARING UNDERWATER MINES AND OBSTRUCTIONS

The detection and removal of underwater mines and obstacles are naval specialties.

a. Obstructions. Berths, slips, and charnels may be blocked by sunken ships, vehicles, debris, and rubble.

b. Harbor clearance. Naval units perform large-scale underwater clearing and salvage. Engineer units may assist or provide equipment and operators.

c. Sweeping. After mine clearance, naval units sweep the water area to locate underwater obstructions.

## INSPECTION OF DAMAGE AND DETERIORATION

a. Conventionally constructed port structures.

(1) Rehabilitation. The decision to rehabilitate or abandon port structures depends on the extent of damage, importance of the structure, and limits on its use.

(2) Wharf inspection. A wharf inspection includes--

* An underwater inspection by divers to check for possible demolition damage or deterioration of footings.

* An inspection of the piling at low water from a boat to check for decay, borer attack, or other damage. The stringers and deck are examined from below to determine the need for repair.

b. Expediently constructed port structures of the future. All military ports constructed in the future should handle the largest containers (67,200 pounds gross weight) within the U.S. container inventory. The most promising design is the large self-elevating, spud-type barge pier discussed in Chapter 11. This pier allows structural items to be inspected above water for damage.

c. Harbor inspection. Breakwaters, jetties, or seawalls are inspected for damage. If breached, such structures are repaired to avoid scour and further damage.

## REPLACEMENT AND MAINTENANCE

Repair corrects damage to facilities. For conventional and proposed construction, repair maintenance consists of the following:

a. Emergency repair. Engineers repair storm, accident, or other damage to forestall further loss and larger repairs. Included are--

(1) Repairing breached breakwaters.

(2) Repairing wharf damage to restore structural strength.

(3) Dumping rock to control foundation scour or beach erosion.

b. Major repair. Major repair is replacement work of nonrecurrent nature, such as--

(1) Replacing wharf decks.

(2) Resurfacing access roads and earth-filled quays.

(3) Replacing wharf bracing and anchorages destroyed by decay or corrosion.

(4) Replacing entire spud barge piers, spuds, or other major barge pier accessories.

## REHABILITATION OF LOCKS AND BREAKWATERS

a. Rehabilitation of locks. Gates are repaired only when they are essential to full operation of the facility.

b. Rehabilitation of breakwaters. Repair of breakwaters and similar structures protects the characteristics of a harbor. Use suitable rock to repair breached breakwaters.